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(71) Applicant(s)
Duflot Industrie
(Incorporated in France)
14 rue de l'industrie, 59157 Beauvois En Cambresis, France

(72) Inventor(s)
Jean Kapuscik
Pierre Lemaire

(74) Agent and/or Address for Service
McNeight & Lawrence
Regent House, Heaton Lane, STOCKPORT, Cheshire, SK4 1BS, United Kingdom

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GB 2246097 A GB 2231789 A FR 002576200 A

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(54) Abstract Title

A composite material for protection against vandalism

(57) A composite material for providing protection against vandalism, in particular for seats, is manufactured by making an assembly of three superposed layers in which the middle layer is an anti-vandalism metal grid, and in holding said three layers together. The outlet first layer (3) is a non-woven fabric (2), and the three layers (3, 5, 7) are held together by single-strike needling using barbed needles having rounded tips, such that after needling, the outside face of the first layer has no wires coming from the second layer, and the outside face of the third layer has a limited number or no wires coming from the second layer.

Needling is performed using needles having rounded tips (13) in which the depth of the barbs (14) is less than half the diameter of each of the wires making up the metal grid, and greater than half the diameter of all or some of the fibers constituting the first layer.

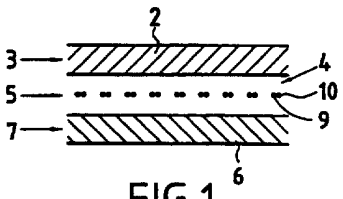

FIG.1

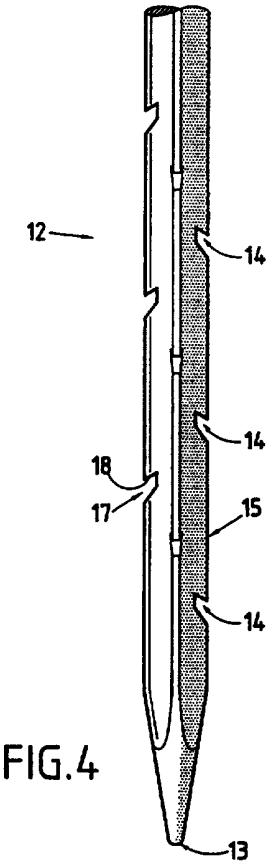

FIG.4

GB 2 327 379 A

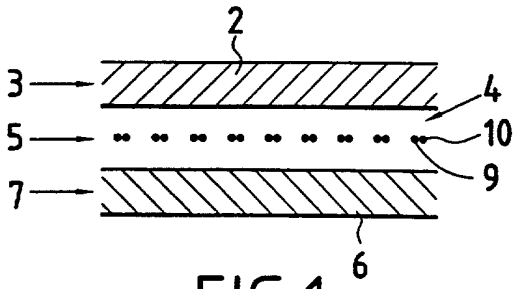

FIG.1

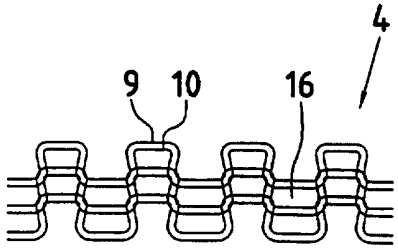

FIG.2

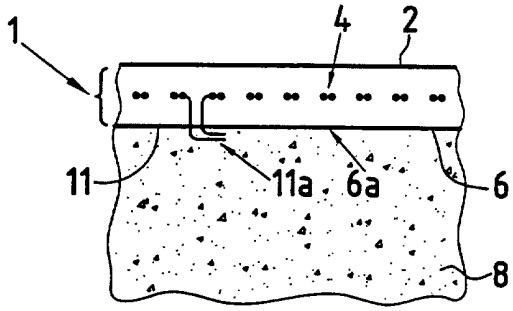

FIG.3

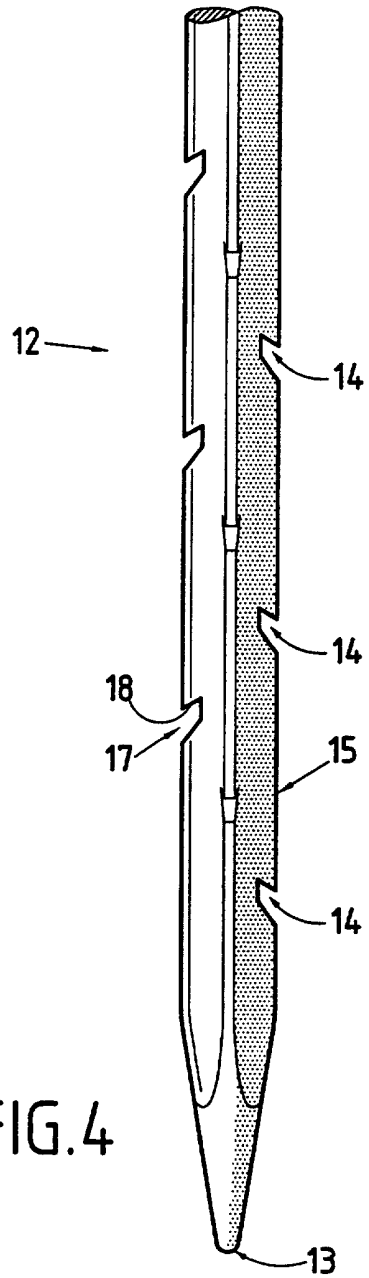

FIG.4

A METHOD OF MANUFACTURING A COMPOSITE MATERIAL FOR PROTECTION AGAINST VANDALISM, IN PARTICULAR FOR SEATS, AND A COMPOSITE MATERIAL OBTAINED THEREBY

The present invention relates to providing protection against vandalism, in particular for seats that are to be placed in public places, in particular in public transport vehicles. The invention relates more particularly to a method of fabricating a composite material suitable for use in making up such a seat, and including a metal grid as means for providing protection against vandalism. The invention also relates to a composite material obtained by the method.

An anti-vandalism covering for seats is known, in particular from document FR 2 576 200, comprising at least three distinct superposed layers, namely a first layer comprising a visible outer covering made of a thin material, an intermediate anti-vandalism second layer made of a knit of thin steel wires, and a third layer or protective underlayer made of a thin flexible material. These three superposed layers are held together to form a composite flexible covering, e.g. by using a flexible adhesive interposed between the first and third layers. In a particular embodiment, the protective underlayer has anti-fire properties and includes at least one non-woven sheet obtained by needling fire-resistant artificial fibers. The third layer preferably includes two needled-together non-woven sheets with a grid of woven glass threads interposed between them. The three composites are assembled together by additional needling.

It is the fine-meshed metal knit which, while nevertheless being deformable, is capable of withstanding laceration, and which therefore protects the other layers of the covering, in particular the foam cushion or padding constituting the bottom portion of the seat as covered by the three-layer covering of document FR 2 576 200.

The Applicant has found that the above-mentioned covering suffers from the drawback of using adhesive between the first and third layers to hold the covering together. The presence of such adhesive can be troublesome,

particularly when the covering is required to have fire-resistant properties, in addition to its anti-vandalism properties, because of the smoke which the adhesive gives off.

To mitigate that drawback, proposals have already been made, in document GB 2 246 097, to bond the three layers by stitching, using the wadding technique, with individual stitching heads serving to make lines of stitches that are spaced apart by distances of 2 cm to 5 cm.

The Applicant has found that the drawback of that technique is that it uses additional thread for stitching, and also that it requires an installation of the wadding type.

The object of the Applicant is to propose a method of manufacturing a composite material for protection against vandalism, in particular for protecting seats, which method, in manners known from the two above-specified documents, consists in making an assembly of three superposed layers in which the middle layer is an anti-vandalism metal grid, and in causing said three layers to hold together.

In a manner characteristic of the invention, the outer first layer is a non-woven fabric and the method consists in holding the three layers together by single-strike needling using barbed needles with rounded tips, such that after needling, the outside face of the first layer is free from any wires coming from the second layer, and the outside face of the third layer has a limited number or no wires coming from the second layer.

The needling technique is indeed conventional for the purpose of bonding together a plurality of layers. For example, in document FR 2 576 200, the protective underlayer is made up of two non-woven sheets with a woven glass grid interposed between them, the assembly being bonded together by needling. It is the fibers making up the non-woven sheets that are moved by the needles of the needling machine, which interpenetrate the various layers and as a result bond the assembly together. If a needle moves a thread constituting the intermediate

grid of woven glass, then that is not troublesome because of the uniformity of the various components of the sheet in the form of textile filaments or fibers.

However, when the middle layer is in the form of a metal grid, in particular a fine-meshed knit, made by knitting one, two, or three wires in parallel, then passing a material having three superposed layers including such a grid through a conventional needling machine gives rise to multiple breaks in the wires constituting the grid and entrains the ends of these wires or the wires themselves through the first and third layers, thus leaving a multiplicity of wires apparent at the surfaces of said layers. This gives rise to a first drawback of weakening the metal grid, and to a second drawback of giving the resulting composite material an appearance that is unacceptable.

The merit of the invention is thus to have gone against the a priori unfavorable prejudice concerning the needling technique and to have proposed special conditions that make it possible with this technique to obtain a product that is acceptable. By using needles having rounded tips, it is possible to limit breakage and to limit the amount of wires that are entrained as the needles pass through, the point of the needle sliding laterally over the wires. In addition, single-strike needling makes it possible even when wires are indeed entrained by the barbs of the needles, to ensure that any such wires which do appear, appear solely on the surface of the third layer, i.e. the layer which is in contact with the padding of the seat in an application to seats. Naturally, in order to obtain bonding by single-strike needling, it is absolutely necessary for the first layer itself to be constituted by a non-woven sheet.

It should be emphasized that the use of rounded-tip needles makes it possible to decease needle breakage to a very significant extent compared with using traditional needles, where breakage is because of said needles striking the wires.

Advantageously, acceptable bonding of the three layers making up the composite material of the invention is obtained by implementing needling at a

density lying in the range 10 strokes/cm^2 to 30 strokes/cm^2.

Advantageously, the first and/or third layer is a non-woven sheet that has been pre-needled at a lower density of needling. It is the additional needling for holding together the three layers of the composite material of the invention which makes it possible to complete needling of the non-woven sheet(s).

Advantageously, the method of the invention includes an additional step which consists in applying pressure treatment to the three layers after needling, thereby causing any wires passing through the outside face of the third layer to lie down. This treatment can be performed either by passing the material between two cylinders or else by compressing it in a hydraulic press.

Advantageously, each rounded-tip needle possesses barbs of a depth that is less than half the diameter of each of the wires making up the metal grid and greater than half the diameter of all or some of the fibers constituting the first layer. This particular disposition is particularly advantageous since it limits or even completely eliminates wires being entrained by the barbs of the needles, while nevertheless enabling said barbs to entrain the fibers of the first layer for the purpose of bonding the three layers together.

The present invention will be better understood on reading the following description of a preferred embodiment of a composite material for protecting the seat of a public vehicle against vandalism and against fire, which material is shown in the accompanying drawing, in which:

- Figure 1 is a diagrammatic section of the three layers prior to superposition and needling;
- Figure 2 is a plan view of the metal knit constituting the second layer;
- Figure 3 is a diagrammatic section through the material after needling, and in contact with an element of padding and,
- Figure 4 is a diagrammatic perspective view of a needle fitted to a needling machine.

The present invention relates to a composite material for providing

protection against vandalism, specifically but not exclusively for public transport vehicle seats. In this composite material, the anti-vandalism function is performed by the presence of a middle layer constituted by a metal grid, and in particular by a fine-meshed metal knit.

The presence of such a metal grid makes it possible to envisage applications other than combatting vandalism, in particular using the composite material of the invention for making garments for protection against bullets or shrapnel, or indeed for making bellows for covering the gap between two compartments in a transport vehicle.

In the example shown in the various figures, the composite material of the invention is made up of three superposed layers, namely: a first sheet of non-woven fibers 2 which constitutes the outer layer 3; a metal knit 4 which constitutes the middle layer 5; and a sheet of non-woven fibers 6 which constitutes the inner layer 7. When the composite material 1 is for use in making a seat, it is the inner layer 7 which comes into contact with an element of padding 8.

The metal knit 4 as shown in Figure 2 is made by knitting two wires 9 and 10 in parallel, each wire having a diameter of about 0.2 mm to 0.3 mm. The pitch of the mesh in the knit 4 is about 10 mm to 15 mm.

In one particular embodiment, the two sheets of non-woven fibers 2 and 6 are pre-needled non-woven fabrics weighing 80 g/m^2 and made up of various fibers with yarn numbers lying in the range 1.7 dtex to 4.5 dtex, having an average diameter of about 12 μm to 15 μm. The three layers 3, 5, 7 are superposed and pass through a conventional needling machine fitted with needles 12 having rounded tips 13, of triangular cross-section with three barbs 14 per edge 15, the nine barbs 14 being helically distributed up the height of the needle 12.

Needling is performed on the basis of twenty strokes per square centimeter, with penetration of 9 mm, given that the distance from the point to

the first barb 14 is 3.2 mm. The depth of a barb is 0.08 mm (80 μm) and the size of its working portion is eighteen gauge. Needling is performed using a single strike, with the needle board being situated above the first layer 3.

During needling, it is fibers of the first non-woven fabric 2 as entrained by the barbs 14 of the needle 12 that pass through the mesh 16 of the metal knit 4 and penetrate amongst the fibers of the second non-woven fabric 6 and that serve to bond together the three elements constituting the composite material 1 of the invention.

The fibers are entrained by the barbs 14 which are located on the edges 15 of each needle 12, with each barb being constituted by a notch 17 surmounted by a projection 18. During penetration of the needle 12, the thread close to the impact of the needle 12 slides along the edge 15, penetrates inwards at a notch 17, and on being held in position by the projection 18 is entrained by the needle 12 as it moves. The thread is locked in position as a function of the shape of the notch 17 and of the projection 18 relative to the diameter of the thread.

In the context of the present invention, it is desirable for fibers of the first non-woven sheet to be entrained selectively to the detriment of the wires of the metal grid.

The Applicant has found that it is appropriate for the depth of the barbs 14 of the needles to be less than half the diameter of each of the wires constituting the metal grid of the second layer and greater than half the diameter of all or some of the fibers constituting the non-woven sheet of the first layer.

For a metal knit made by knitting together two parallel wires, each wire having a diameter of about 0.26 mm (260 μm), and for a first layer constituted by a non-woven sheet made up of fibers having a mean diameter lying in the range 12 μm to 19 μm, the Applicant has decided to work with a needling machine having needles whose barbs have a depth of about 0.08 mm (80 μm).

The rounded tip 13 of the needle 12 is defined so as to slide laterally over the wires of the steel knit without damaging them. For an 18 gauge needle

12, the tip 13 is a hemisphere having a diameter of 0.30 mm.

It is thus possible to make the composite material 1 of the invention without breaking many needles. When using needles whose barbs nevertheless entrain locally one or other of the wires 9, 10 making up the metal knit 4, all projecting wires 11 that are obtained at the outlet from the needling machine will be in the form of spikes extending perpendicularly to the general direction of the material 1.

The height of such spikes depends on needle penetration and on the thickness of the composite material. In any event, it is possible to remedy the drawback of having vertical spikes locally by applying treatment to the material 1 after needling for the purpose of folding down the spikes onto the outside face 6a of the second sheet of non-woven fibers 6. This treatment may consist in causing the material 1 to pass, after needling, between two sealed cylinders of the padder type with determined pressure being exerted therebetween, or by compressing said composite material 1 in a hydraulic press.

Under such circumstances, the visible ends 11a of the spikes are folded down and lie in the plane of the outside face 6a of said non-woven fabric 6.

Because of the needling that is to bind together the three layers 3, 5, and 7, it is possible to make use of sheets of non-woven fibers 2, 6 that have previously been subjected to a smaller amount of needling. The needling density difference will be of the same order as the needling density implemented for bonding together the three layers 3, 5, and 7.

The non-woven fabrics 2 and 6 are preferably made from fibers that have fire-resistant characteristics. Advantageously they are polyacrylate fibers, such as those sold under the trade name INIDEX. They may also be constituted by a mixture, such as that recommended in document EP 258 513.

The present invention is not limited to the embodiment described above by way of non-exhaustive example. In particular, the third layer 7 may be constituted by a textile fabric that is woven or knitted and need not be a sheet of

non-woven fibers.

Finally, it should be observed that selecting which wires or fibers are to be entrained by the barbs of a needle in the manner described above in the context of the method of manufacturing a composite material for protection against vandalism is not limited in any way to that particular application, which happens to use three superposed layers with a middle layer that is constituted by a metal grid. The principle of making a selection in this way can be applied more generally in the field of needling with barbed needles, whether conventional or special, having rounded tips or sharp tips, whenever it is necessary to enhance entrainment of one particular component (fibers or wires) in a sheet made up of at least two components (fibers or wires) of different diameters. In this context, needles are selected such that barb depth is greater than the radius of the component that is to be entrained preferentially and less than the radius of the other component. Naturally, variants can be envisaged in which the section of one or other of the composites is not circular.

CLAIMS

1/ A method of manufacturing a composite material for protection against vandalism, in particular for protecting seats, the method consisting in making up an assembly of three superposed layers in which the middle layer is an anti-vandalism metal grid, and in securing said three layers to one another, the method being characterized in that the outer first layer (3) is a non-woven fabric (2), and the method consists in holding the three layers (3, 5, 7) together by single-strike needling using barbed needles with rounded tips, such that after needling, the outside face of the first layer is free from any wires coming from the second layer, and the outside face of the third layer has a limited number or no wires coming from the second layer.

2/ A method according to claim 1, characterized by a needling density lying in the range 10 strokes/cm^2 to 30 strokes/cm^2.

3/ A method according to claim 1 or 2, characterized in that at least one of the first and third layers (3 and 7) is a non-woven sheet pre-needled at a low needling density.

4/ A method according to any one of claims 1 to 3, characterized in that it includes an additional step consisting in applying pressure treatment to the three layers (3, 5, 7) after needling, thereby laying down any wires (11) that pass through the outside face (6a) of the third layer (7).

5/ A method according to any one of claims 1 to 4, characterized in that the needling is performed using needles in which barb depth is less than half the diameter of each of the wires constituting the metal grid and greater than half the diameter of any or some of the fibers constituting the first layer.

6/ A method according to any one of claims 1 to 4, characterized in that the metal grid is made by knitting parallel wires having a diameter of about 260 μm, and the first layer is a non-woven sheet made up of fibers having a diameter of the order of 12 μm to 19 μm, needling being performed by means of needles having barbs with a depth of about 80 μm.

The Patent Office

11

Application No: GB 9815465.1
Claims searched: 1 to 6

Examiner: R.J.MIRAMS
Date of search: 16 September 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B5N

Int Cl (Ed.6): A47C 7/26. B32B 5/06, 7/08.

Other: ONLINE: WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB2246097A	(TBA Industrial Products)	
A	GB2231789A	(Scandus Design)	
A	FR2576200A	(Sofanor)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.